HIGH TRANSPARENCY TOUCH SCREEN

BACKGROUND

[0001] A touch screen offers a simple, intuitive interface to a computer or other data processing device. Rather than using a keyboard to type in data, a user can transfer information through a touch screen by touching an icon or by writing or drawing on a screen. Touch screens are used in a variety of information processing applications, and have been found to be particularly useful in interactive systems that also include a computer-controlled display. Touch screens are used in applications such as mobile phones, personal data assistants (PDAs), handheld or laptop computers, as well as publicly located information kiosks, automatic teller machines, and point-of-sale terminals.

[0002] Various technologies have been developed to sense touch, including capacitive, resistive, acoustic, and infrared techniques. Resistive technologies typically detect touch by sensing a change in an electrical signal caused by contact between two transparent conductive layers. The resistive touch sensor may be energized by the application of a drive signal from a controller coupled to one or more of the conductive layers. A touch applied to the surface of the resistive touch sensor deflects a first flexible, conductive layer, causing the first conductive layer to make contact with the second conductive layer. Contact between the first and second conductive layers causes a change in a sensed electrical signal. The location of the touch is determined as a function of the point of contact between the conductive layers.

[0003] A touch on the surface of a capacitive touch sensor changes the impedance of the touch sensor circuit at the touch location, and causing a change in an applied electrical signal. For example, an AC signal may be applied to electrodes positioned at four corners of a transparent, conductive layer of the capacitive touch sensor. A finger touch on the touch sensor surface capacitively couples the touch sensor to ground. The capacitively coupled circuit alters the impedance, which produces a change in a sensed electrical signal. The change in the electrical signal is detected at each electrode, and the relative change in the signal at each electrode is used to determine touch position.

[0004] Both resistive and capacitive touch sensors may make use of thin film electrodes formed of a transparent metal oxide. The optical and electronic properties of metal oxide films are strongly interrelated.

SUMMARY OF THE INVENTION

[0005] According to one embodiment, a touch sensor includes a transparent conductive layer coupled to a transparent insulating layer. The transparent conductive layer incorporates an intended plurality of voids arranged according to a random pattern. The voids are arranged to maintain the electrical continuity of the transparent conductive layer.

[0006] Another embodiment of the invention involves a method for manufacturing a high transparency touch sensor. A transparent conductive layer is disposed on a substrate. Voids are formed in the transparent conductive layer according to a random pattern.

[0007] The above summary of the present invention is not intended to describe each embodiment or every implementation of the present invention. Advantages and attainments, together with a more complete understanding of the invention, will become apparent and appreciated by referring to the following detailed description and claims taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] **FIG. 1A** is a diagram illustrating a high transparency resistive touch sensor in accordance with an embodiment of the invention;

[0009] **FIG. 1B** is a diagram illustrating a high transparency capacitive touch sensor in accordance with an embodiment of the invention;

[0010] **FIG. 1C** is a diagram of a transparent conductive layer incorporating voids arranged in a random pattern in accordance with an embodiment of the invention;

[0011] **FIG. 2** is a block diagram of a touch sensing system using a high transparency touch sensor in accordance with an embodiment of the invention; and

[0012] **FIG. 3** is a flowchart illustrating a method for manufacturing a high transparency touch sensor in accordance with an embodiment of the invention;

[0013] While the invention is amenable to various modifications and alternative forms, specifics thereof have been shown by way of example in the drawings and will be described in detail. It is to be understood, however, that the intention is not to limit the invention to the particular embodiments described. On the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the scope of the invention as defined by the appended claims.

DETAILED DESCRIPTION OF VARIOUS EMBODIMENTS

[0014] In the following description of the illustrated embodiments, reference is made to the accompanying drawings which form a part hereof, and in which is shown by way of illustration, various embodiments in which the invention may be practiced. It is to be understood that the embodiments may be utilized and structural changes may be made without departing from the scope of the present invention.

[0015] The present invention is directed to methods and systems for enhancing optical transmission through touch sensors using transparent conductive elements. Resistive and capacitive touch sensing methodologies, for example, typically incorporate transparent conductors as active elements of the touch sensor device. The transparent conductive oxide most widely used in these applications is indium tin oxide (ITO), although other metal oxides, such as antimony tin oxide (ATO) and tin oxide (TO) are also used. Metal/metal oxide stacks can also be used, for example employing a very thin metal layer on top of a metal oxide layer or between the substrate and a metal oxide layer. It is also possible to use organic conductors such as conductive polymers.

[0016] A desired sheet resistance of the transparent conductive layer may be achieved during deposition by maintaining a selected material thickness. However, depositing a relatively thin layer of metal oxide to achieve a high sheet resistance and high optical transmission may present chal-